Section 5

Data Summary/Data Gaps

5.1 Biological Resources

Ecologically, the offshore rocks of the CCNM are important in providing nesting and roosting habitat for numerous seabirds and haulout areas and rookeries for marine mammals. These rocks also support a diverse rocky intertidal zone assemblage of plant and animal species. A small number of the larger rocks also have sufficient soil to support a diversity of coastal plant communities. The status of information on these resources that is available for CCNM planning is summarized below.

Seabird Use Areas

Information Available: The locations and relative sizes of California's seabird populations are generally well known, and monitoring information is moderately comprehensive (Sowls et al. 1980; Briggs et al. 1987; Tyler et al 1993; Mad River Biologists 2002). However, much of the information has been collected opportunistically and is now notably dated for many areas. Information on the habitat requirements and ecology of most species is reasonably well documented in species accounts and research papers (Mad River Biologists 2002).

Data Gaps: The current status and population trends of many of the seabird colonies in the CCNM are largely unknown. There have been no systematic surveys of California's seabird colonies on offshore rocks since the 1980s. While some of the larger seabirds (e.g., Common Murre) have been surveyed from the air, many small breeding populations of seabirds have not been visited since the statewide survey work of Sowls et al. (1980). Moreover, information on actual and potential disturbance of these colonies from recreational and/or commercial activities has not been developed.

Future Needs: Comprehensive coordinated surveys of all seabird colonies within the CCNM are needed to document the current status of all species. Development of a long-term monitoring program is needed to provide baseline information on population trends. Identification and ranking of all potential disturbance activities and areas of highest potential impact on nesting seabirds along the coast is needed to monitor and manage these activities. Specific research on the ecological changes resulting from space and food resource

availability, competition between sympatric species of seabirds, and changing weather and oceanic patterns such as El Niño is also needed to assess the causes of seabird population changes within the CCNM.

Sea Mammal Use Areas

Information Available: Northern fur seal, Guadalupe fur seal, Steller's sea lion, California sea lion, Pacific harbor seal, and northern elephant seal all use offshore rocks within the CCNM for haulout areas and/or breeding rookeries. Sea otters, too, are often closely associated with these rocks in adjacent kelp beds, which provide shelter, foraging, and resting areas. General information on the biology and ecological requirements of these species is widely available in species accounts and numerous research reports. Known haulout areas and rookeries within the CCNM are surveyed annually by NOAA Fisheries and DFG (e.g., Carretta et al. 2001, 2002). The results of these and other smaller surveys conducted for more local areas (e.g., NPS national marine sanctuaries) and recent scientific research on these species are summarized in NOAA Fisheries marine mammal assessment reports. These reports provide regularly updated information on the status and trends of all marine mammals within the CCNM.

Data Gaps: Available stock information appears sufficient to locate and document important pinniped use areas within the CCNM to facilitate long-term planning and management. However, some of the annual surveys are not comprehensive; moreover, some species surveys are only periodic, depending on funding.

Future Needs: Enhanced monitoring of all species is needed to provide more detailed information on population trends, species behavior, and ecological status. Long-term monitoring is needed to document potential impacts of increasing recreational and other activities on traditional haulout/rookery areas. Ecological information is needed on the effects of pronounced weather and oceanic changes, such as El Niño, on pinniped distribution, movement, demographics, and forage availability. Long-term cooperative research and monitoring programs between state and federal wildlife agencies and interested universities should be established to ensure that comprehensive documentation of the status of all wildlife resources within the CCNM is achieved and maintained.

Rocky Intertidal Areas

Information Available: In addition to containing important features of seabird and marine mammal habitat, the CCNM includes a significant amount of California's rocky coast ecosystem and intertidal zones – the "border between two worlds." This border, the intertidal, is between the land and the sea. It is one of the harshest natural environments on earth. The rocky intertidal zones encompass all of the land touched by the tides, from the upper limits splashed by waves only at high tide to the lowest depths that are exposed only at the lowest low tides. The CCNM portion of this "fluid boundary" is within the "splash

zone" (Zone 1) and upper part of the "high intertidal zone" (Zone 2), two of the four major zones within the intertidal. As a result, the CCNM contains some of the most rugged and unique aspects of California's intertidal zones. It is here that the hardiest of intertidal animals (e.g., limpets, periwinkles, and chitons) and plants (e.g., microscopic algae and sea palms) survive, their limits set primarily by physical factors (e.g., how much sun, wind, and drying they can tolerate). Although a considerable amount of scientific study has been conducted over the past 50 years on California's littoral ecology, most of this work has been done on intertidal zones along the mainland. Due to the difficulty of access, only limited work has been conducted on the offshore rocks.

Data Gaps: Adequate generalizations about the various species occurrences and habitat variations within the CCNM's rocky coast ecosystem and intertidal zones can be made from available data. Available data do not, however, provide for the identification of possible differences between the mainland littoral ecosystem and intertidal zones and those of the offshore rocks and small islands.

Future Needs: Research that focuses on identifying the links and differences between the mainland intertidal and that of the offshore rocks and small islands should be encouraged.

Special-Status Plants and Wildlife

Information Available: Information on special-status species is restricted to survey information for seabirds and pinnipeds and incidental sightings of other bird species. Numerous studies have been conducted on the Channel and Farallon Islands to document endemic species. This information would be valuable for comparative studies of species occurrences on large and small offshore rocks within the CCNM.

Data Gaps: Virtually nothing is known about the occurrences of special-status plants and non-seabird wildlife on the offshore rocks within the CCNM. Very few studies have been conducted on any of the rocks, and these have been of limited scope. Information on invertebrates and fish is particularly needed.

Future Needs: A comprehensive, coordinated interagency inventory should be conducted of the flora and fauna on the offshore rocks of the CCNM.

Research Areas and Ecological Preserves

Information Available: The isolated nature of the offshore rocks within the CCNM has protected many of the ecological communities from changes resulting from human access and intervention. Remnant relictual communities on these rocks offer significant opportunities to study historic conditions of coastal ecological communities. However, no evidence of such focused studies was found.

Data Gaps: No comprehensive inventory of existing research activities or areas with research potential has been found.

Future Needs: A coordinated interagency assessment of the CCNM's research value and preserve potential is needed to support a management strategy for research and ecological preserves.

5.2 Cultural Resources

Historically, California's offshore rocks and islands have been directly utilized by human populations as temporary landing areas and have indirectly served as directional beacons for both offshore and onshore navigation. They may also be regarded as traditional cultural properties by the descendants of Native American groups in whose mythologies they feature prominently. Additionally, beach deposits on offshore rocks may contain evidence of historical shipwrecks that occurred when ships collided with the rocks or were driven onto them. The status of historical information available on these resources for CCNM planning is summarized below.

Prehistoric Resource Potential of Offshore Rocks and Islands in the CCNM

Information Available: Coastal sites and staging areas for prehistoric and ethnographic fishing, marine mammal hunting, and other resource gathering activities are many and have been reasonably well documented in the archaeological and ethnographic literature. The same is true of islands that are larger or are in close proximity to the mainland (i.e., Channel Islands and Gunther Island). Because of inaccessibility and lack of development, however, archaeological survey information for smaller offshore islands and rocks is extremely limited. The California Historical Resources Information System (CHRIS) includes information for larger islands (i.e., Channel Islands and Farallon Islands) that would be useful for predictive modeling for archaeology that may be present in the CCNM. Published ethnographic literature for coastal tribes discuss how these offshore rocks and islands were used for procuring resources and as meeting areas to discuss matters of importance with other villages and tribes (Gould 1978: Bean and Theodoratus 1978).

BLM has contracted with the California State Historic Preservation Officer (SHPO) to convert existing cultural resource records (including CHRIS data) for the CCNM study area to GIS format so that this information can be more easily overlaid on other geographic and resource maps along the California coast. This mapped information is expected to be available for use in the CCNM resource management planning effort.

Data Gaps: Archaeological sites on offshore rocks and islands are largely unknown in the CCNM; the potential for such sites is limited to larger rocks

accessible by watercraft. No systematic surveys have been conducted, few sites have been recorded, and the integrity and condition of offshore sites, which are subject to weathering and erosion, are unknown.

Future Needs: A records search of the CHRIS for areas in and around the Channel Islands and Gunther Island should be undertaken to provide information that would be useful for predicting what types of prehistoric sites could be present on offshore rocks in the CCNM. Archaeological survey of larger islands and rocks, where accessibility is not an issue, is needed to develop at least a partial inventory of sites present in the CCNM. Archaeological survey and inventory would also provide an opportunity to assess the integrity and condition of sites present. Research of published ethnographic information on coastal Native American groups should be undertaken to gain a better understanding of which groups were using these islands and offshore rocks and what they were using them for.

Historical Resource Potential of Offshore Rocks and Islands in the CCNM

Information Available: Historical literature and photographs show that offshore rocks and islands have been used for multiple purposes since the arrival of Europeans at the California coast. They have also been responsible for numerous shipwrecks throughout California's history. Shipwreck debris from the mid-nineteenth century is still present on some offshore rocks (Del Cioppo 1983). Earliest European use of these offshore rocks and islands dates back to the mid-1500s, when explorers first visited the California coast (Cummings 1975). Ships' logs from Cabrillo in 1539 and Drake in 1579 indicate that the early European explorers hunted sea lions and birds on the Farallon Islands and along the northern California coast. Later, the Spanish and Russians used offshore rocks for hunting activities and for docking or anchoring their ships. These rocks were also used in the nineteenth and twentieth centuries to stabilize logging flumes that would convey timber to ships that had to anchor offshore due to lack of piers or shoreline docks. Some of the offshore rocks and islands also served as locations for navigational aids such as lighthouses (Woodward 1984).

Data Gaps: Historical documents discuss uses of offshore rocks and islands, but archaeological sites are largely unknown due to a lack of fieldwork. No systematic surveys have been conducted, few sites have been recorded, and the integrity and condition of offshore sites, which are subject to weathering and erosion, are unknown.

Future Needs: Historical research of archives and documents should be conducted to gain a better understanding of how offshore rocks and islands were used in the past. Consultation with local historians and historical societies should also be undertaken. Such research would be helpful in revealing which rocks and islands were used and who was using them. Archaeological survey of islands and rocks, where accessibility is not an issue, is needed to develop at least a partial inventory of sites present in the CCNM. Archaeological survey and

inventory would also provide an opportunity to assess the integrity and condition of sites present.

Offshore Rocks and Islands as Traditional Cultural Properties

Information Available: Traditional Cultural Properties (TCPs) are so designated because of their association with cultural practices or beliefs of a living community that are (a) rooted in that community's history, and (b) important in maintaining the continuing cultural identity of the community. The term "traditional" in this context refers to the beliefs, customs, and practices of a living community of people that have been passed down through generations, usually orally or through practice (National Park Service 1990). Ethnographic fieldwork has been conducted with many of the Native American groups along the California coast, though more has been conducted for some groups than for others. Offshore rocks and islands play an important role in the mythologies of many of these Native American groups; they have also served, and continue to serve, as traditional resource procurement areas (Loeb 1926: Kroeber 1925). While this ethnographic information is useful, it is not the only step necessary in determining the locations and significance of potential TCPs.

Data Gaps: Research of ethnographic literature provides valuable information and is a good basis from which to begin research on potential TCPs. Unfortunately, ethnographic literature often does not identify a particular place as playing an important role in the tradition and culture of a group, while contemporary members of the group would be able to name them specifically.

Future Needs: The process of researching TCPs should begin with a review of available ethnographic literature on Native American groups along the California coast. Agencies that may have information on potential TCPs, such as the State Historic Preservation Officer (SHPO) and the California Native American Heritage Commission (NAHC), should be consulted. Groups that may ascribe traditional cultural values to offshore rocks and islands should be contacted and asked to assist in organizing information pertinent to their specific areas. Fieldwork to identify TCPs should involve consultation with knowledgeable groups or individuals, such as representatives of tribal councils, coupled with field inspection and recordation of locations identified as significant by such groups or individuals.

5.3 Land Use and Access

Information Available: The most comprehensive catalog of public coastal access is the 1997 California Coastal Access Guide, produced by CCC (California Coastal Commission 1997). CCC has indicated its willingness to share information to support the CCNM RMP process and is the best source for updated public access information. Land use information may be obtained by

examining general plans of the cities and counties along the coast and by viewing coasta1 aerial photography available at www.californiacoastline.org.

Data Gaps: Available information appears sufficient to assess access and land use adjacent to the CNNM at a broad scale.

Future Needs: If site-specific management actions are developed in the RMP, it may be necessary to visit specific locations adjacent to the CCNM to determine current land use and access conditions.

5.4 Recreation Activity

Current Use Estimates by County

Information Available: Twelve California counties encompass the coastline of the CCNM. In 2002, these counties had an estimated 173.5 million visitors (California Technology, Trade and Commerce Agency – Office of Economic Research and Strategic Initiatives 2003a). The 54 state beaches along the coastline hosted 37,907,037 visitors, and beach visitation is rising (California State Parks 2003a). An additional 22,346,085 visitors were counted at just nine of the 80 recreational areas located along the coastline (California Technology, Trade and Commerce Agency – Office of Economic Research and Strategic Initiatives 2003b; Santa Monica Mountains National Recreation Area 2003).

Data Gaps: Visitation data are somewhat variable depending on locale. Many local, state, and federal coastal recreation sites do not have accurate visitation numbers; some have none. Most recreationists will access the CCNM through these publicly accessible recreation sites; accordingly, future management of the CCNM will require accurate counts of coastal users to determine potential impacts on the area.

Future Needs: Accurate visitation numbers from local, state, and federal coastal recreation sites are needed

Recreational Activity and Wildlife Disturbance

Sea Kayaking/Canoeing

Information Available: Kayakers and canoeists can significantly disturb seals and sea lions if they approach too close. Kayakers as far as a half mile away can induce panic in seals at haulouts if their movement suggests "stalking behavior (i.e., changing course toward the seals or changing speed) (Shaw 1991; Shaw and Cowperthwaite 1991; Monterey Bay National Marine Sanctuary 2003a). Seals and sea lions seem least bothered by relatively distant boats follow passing courses at steady speeds.

Data Gaps: Additional research is needed on specific interactive behaviors between kayakers/canoeists and marine mammals to determine distance and action guidelines that will minimize wildlife impacts.

Future Needs: Additional research is needed on specific distance requirements to minimize disturbance of marine mammals from kayaking and canoeing; on the basis of this research, recreational guidelines will have to be developed and promoted to kayaker and canoer groups.

Motor Boating (including Recreational, Fishing, and Wildlife Viewing)

Information Available: In some locations, the increase of coastal recreational boating traffic has affected the spatial distribution, movement patterns, and abundance of birds and marine mammals (Sorensen et al. 1984; Thiel et al. 1992; Mikola et al. 1994). Disturbance during the harbor seal pupping season can cause mortality of some pups as a result of separation or abandonment. Haulouts subject to a high level of disturbance may be abandoned completely (Monterey Bay National Marine Sanctuary 2003a; Seal Conservation Society 2003a). A small number of elephant seals, sea lions, and southern sea otters are killed by boat collisions (Friends of the Sea Otter 2003a; Seal Conservation Society 2003b).

Data Gaps: Few studies have been conducted on the impacts of motor boating on marine wildlife or on the specific needs for management of potential disturbance activities and protection of sensitive areas.

Future Needs: Additional studies are needed on the specific impacts of motor boating on marine wildlife within the CCNM. Moreover, distance guidelines to minimize wildlife impacts should be developed.

Scuba Diving/Snorkeling

Information Available: Scuba diving and snorkeling activities can potentially affect marine wildlife within the CCNM through disturbance and removal of species that are important food sources for marine mammals (Monterey Bay National Marine Sanctuary 2003a). The Northern California Diver's Association estimates that the number of divers in the central coast rose 10–20% in the 1980s, and 5–7% in the 1990s. The Monterey Bay area, in particular, is a world-renowned dive destination, with an estimated 70% of all dives from the southern tip of the Monterey Bay National Marine Sanctuary to Oregon occurring in the stretch from Cannery Row in Monterey to Point Lobos State Reserve south of Carmel. Other popular dive spots include Carmel Bay Ecological Reserve and Julia Pfeiffer Burns State Park.

Dive spearfishing in northern and central California doubled between the late 1950s and the mid-1980s (Monterey Bay National Marine Sanctuary 2003a).

Spearfishers tend to target large shallow-water fishes, especially lingcod and rockfishes.

Data Gaps: Additional research is needed on the growing trends in diver activities along the coast and the impacts of those activities on wildlife. Specific information is needed on access locations and proximity of these areas to sensitive wildlife resources.

Future Needs: Comprehensive diving activity surveys should be conducted along the coast to identify increasing trends in specific activities that affect marine wildlife within the CCNM. All access areas should be identified and evaluated with regard to their proximity to important wildlife resources such as marine mammal haulout areas and seabird rookeries. Recreational guidelines and outreach programs are needed to inform the public of the presence and sensitivities of local marine wildlife and to provide recommendations for minimizing impacts on these resources.

Flyovers

Information Available: Airplanes and helicopters that fly close to marine mammal haulout areas and seabird rookeries significantly affect these species through disturbance and stress.

Data Gaps and Future Needs: The potential impacts of recreational, military, and law enforcement flying on coastal resources have not been assessed in rigorous studies. Additional research is needed on the impacts of flyovers on all wildlife species within the CCNM. Flight guidelines and outreach programs are needed to inform the public and agency personnel of the presence and sensitivities of local marine wildlife to flying and to provide recommendations for minimizing impacts on these resources.

Surfing

Information Available: California is one of the most popular surfing areas in the world. California is home to about 45% of the nation's 1.6 million surfers (Surf Industry Manufacturer's Association 1995); the sport has been practiced in California since the turn of the century. Surfing takes place along the entire coastline, but it tends to be focused in areas within a few hours drive of urban regions (southern California coast and greater San Francisco Bay Area) where beach/shore conditions are favorable. Because of the localized nature of the sport based on surf conditions, surfer/wildlife interactions and impacts will also be localized and therefore will need to be addressed and monitored on a site-by-site basis.

No examples were found to substantiate the impact of surfing on pinniped and bird species, although it is assumed that surfers, like kayakers and canoers, can flush wildlife from their haulouts and roosting areas as they near the shore.

Data Gaps: The potential impacts of surfing on coastal resources have not been assessed. There is currently a gap in existing data regarding the locations within the CCNM that are frequently used by surfers and marine wildlife, as well as minimum distance guidelines to reduce wildlife impacts.

Future Needs: Additional research is needed in this area to identify areas within the CCNM that are frequently used by surfers and marine wildlife, as well as determining specific distance guidelines to minimize wildlife impacts.

Onshore Related Activities (Wildlife Viewing/ Collecting)

Information Available: Characteristic impacts of human use include reductions in the diversity, abundance, and individual size of several intertidal species (Monterey Bay National Marine Sanctuary 2003a). Human use of tide pools, beaches, and other areas may inadvertently disturb some endangered species, including California brown pelican, or seals and sea lions (Channel Islands National Park 2003). Impacts of wildlife watching can include disturbance to wildlife and trampling of sensitive areas such as wetlands, mudflats, and sand dunes (Monterey Bay National Marine Sanctuary 2003a). Increasingly, humans visit the rocky shore as naturalists and sightseers, to collect bait and "souvenirs," and to harvest food; trampling from foot traffic is unavoidable during such activities (Monterey Bay National Marine Sanctuary 2003b). If human disturbance is too great, wildlife such as pinnipeds will abandon haulout sites and rookeries, potentially decreasing reproductive success (Monterey Bay National Marine Sanctuary 2003c).

Data Gaps: Several studies have been conducted on the impacts of wildlife watchers and general beach recreationists on wildlife species; however, no research was found to indicate any conflict between wildlife watchers on coastal bluffs and wildlife species located on offshore rocks and islands. Additional research is needed in both these areas, including specific distance guidelines to minimize wildlife impacts. Some wildlife haulout and roosting areas might need additional protection through development of no-access boundaries.

Future Needs: Additional research is needed on the nature and trends of impacts of wildlife watching on coastal wildlife. Species-specific distance guidelines are needed to educate the public on the best ways to avoid and minimize impacts on the wildlife they are observing.

5.5 Educational and Interpretive Material

Interpretive Materials

Information Available: A number of organizations, government entities, and individuals have provided good interpretive materials on ways to minimize

recreation-related impacts on intertidal resources. Point Reyes National Seashore (2003a) offers a *Guide to Low-Impact Boat Camping* that tells how to operate kayaks, canoes, and motor boats to avoiding disturbing wildlife; how to build low-impact fires; and how to handle garbage disposal. Friends of the Elephant Seal (2003a) provide tips for safely viewing elephant seals. Farallons Marine Sanctuary Association (2003) has developed three educational pieces to help kayakers and walkers reduce disturbance to wildlife: *Paddler's Wildlife Viewing* is a small, laminated, colorful card that can be attached to kayaks as a reminder to keep a considerate eye out for wildlife. A larger version of both *Paddler's Etiquette: PADDLE* and *Walker's Etiquette: WALKER* serve as colorful flyers for distribution in kayak shops, visitor centers, and by other organizations. Orange County Parks (2003) developed *Good Tidepooler Rules* while PADI's Project Aware developed both *Tips for Divers* (2003a) and *Tips for Ecotourists* (2003b) to help divers and travelers minimize their disturbance of coastal resources. Watchable Wildlife Inc. (2003) should have *Guidelines for Viewing Marine Wildlife* available by the end of 2003 on the best ways to interact with marine and coastal wildlife species. California Kayak Friends Club (2003) provides a list of locations for kayakers to access the water, as well as sites where wildlife is prevalent. The Bay Area Sea Kayakers (2003) recommends that kayakers and canoeists maintain distances of at least 100 feet from birds onshore, 300 feet from pinnipeds onshore, and 50 feet from pinnipeds in the water.

Data Gaps: Interpretive materials are predominantly available for specific wildlife species, such as elephant seals, or for select recreational uses: kayakers/canoeists, coastal wildlife walkers, and divers. No information was found to address other wildlife species or recreational uses such as motor boating or recreational flying. A quick review of coastal recreational user websites indicates that very little information is circulated regarding proper wildlife etiquette. Guidelines are needed for each recreational activity addressing how users can minimize recreational impacts on wildlife and cultural resources.

Future Needs: New or modified interpretive materials are needed to address all CCNM wildlife and cultural resources, as well as all coastal recreation uses that may affect these resources. These materials should then be distributed to recreational use groups to further disseminate to their members.

Rules and Regulations

Information Available: Various recreational areas provide rules and regulations to minimize recreational impacts on coastal resources and to ensure human safety. These areas include Año Nuevo State Reserve (California State Parks 2003b), Cabrillo National Monument (2003b) and Point Reyes National Seashore (2003b).

Data Gaps: It will be necessary for the CCNM to identify proper rules and regulations for use of the area. By reviewing existing rules and regulations and gauging their effectiveness, it will be easier for the CCNM to incorporate these into its management policies.

Future Needs: Existing rules and regulations should be compiled and public responses to them should be monitored to evaluate effectiveness toward minimizing impacts on coastal resources.

Public Viewing Opportunities

Information Available: Numerous public viewing opportunities, particularly of pinniped species, are available along the California coastline. These species include the sea lions of San Francisco's Pier 39 (The Humane Society of the United States 2003) and the elephant seals of Point Reyes National Seashore (2003c) and Año Nuevo State Reserve (California State Parks 2003b).

Data Gaps: Portions of the CCNM will be accessible by different types of recreational users; however, no information was found on existing sites where public viewing opportunities occur. Further, it is unknown whether these public viewing opportunities are safe or appropriate.

Future Needs: The locations within the CCNM where public viewing opportunities currently take place and/or where large concentrations of wildlife species exist need to be identified and monitored to identify appropriate locations where public viewing opportunities could safely take place with minimal impacts on CCNM resources. It may also be necessary to work with adjoining landowners to provide such opportunities.

Volunteer and Docent Programs

Information Available: Various recreation areas and organizations have formed volunteer and docent programs to minimize and monitor impacts on coastal wildlife resources. Friends of the Elephant Seal (2003b) was formed in November of 1997 to answer questions and help visitors get the most from their elephant seal viewing experience. SEALS, a harbor seal monitoring and interpretation program along the central California coast, was developed to respond to high levels of disturbance to harbor seals (Farallons Marine Sanctuary Association and Gulf of the Farallons National Marine Sanctuary 1991). The Surfrider Foundation (2003) Beachscape Program monitors beaches and disseminates information to local groups, interested citizens, and coastal management agencies. Project Pacific's (2003b) Coastal Watchers observe coastal events and record data on a daily basis by means of the organization's website.

Data Gaps: It is unknown whether development of a volunteer/docent program would be beneficial for the CCNM. However, in certain recreation areas and under the auspices of certain organizations, such volunteers serve the useful purpose of encouraging proper wildlife viewing etiquette and minimizing recreational impacts on wildlife and cultural resources.

Future Needs: Development of a Friends/Volunteer organization to assist with various efforts should be considered.

5.6 Geology

Information Available: Information on the geology of the California coast is available from a variety of sources, including the U.S. Geological Survey, the California Geological Survey (1:250,000 mapping series) and numerous larger-scale mapping efforts conducted by state and federal government and university researchers. A comprehensive listing of sources of information is available at the California Resources Agency's Ceres web site (www.ceres.ca.gov). Because many of the CCNM rocks and islands are extremely small, they are not always represented on geologic maps. Their geologic nature can, in some cases, be inferred by mapped designations for adjacent mainland.

Data Gaps: Information available from state and federal government documents is adequate to identify the general geology of the CCNM. No evidence was found that unique or economically significant geologic resources have been inventoried in a systematic way along the entire California coast. Individual rocks and islands may act as representative type locations for certain geologic formations or may have special interpretive value to geologic research along the coast.

No central source of geomorphologic information was found for the coast's rocks and islands; moreover, no information was found describing the presence or absence of Pleistocene sediments. This information can be used to determine the potential for habitat for certain bird and plant species, and can be an indicator of the potential for cultural resources, fossils and plant communities.

Future Needs: A thorough review of the existing geologic literature for the coast should be conducted to identify rocks and islands that are considered unique or especially valuable to research and geologic interpretation. This review should seek both lithologic and geomorphologic information, as both would be valuable for management decisions. This review could identify geologic resources worthy of future research or interpretation in concert with the biological values of the CCNM.

5.7 Paleontology

Information Available: The availability of information on paleontological resources along the California coast has not been thoroughly researched at this time. BLM has concluded some preliminary research on this subject and an internal report has been prepared. This information is available to the study team. The largest single repository of paleontological information in the state is housed at the University of California Museum of Paleontology in Berkeley, California. Other sources of information include the California Academy of

Sciences, the Los Angeles Museum of Natural History, and the San Diego Natural History Museum. Additional research for information sources is being conducted to support the RMP process.

Data Gaps:

Future Needs:

5.8 Major Coastal Fishing Grounds

Information Available: DFG may be able to provide fish landing data for commercial fishing grounds off the coast of California. Information on abalone collection may also be available from DFG. Annual surveys conducted by NOAA Fisheries and DFG of known haulout areas and rookeries within the CCNM may also provide information on the impact of commercial fishing. Data collected on research sites may provide some ancillary information on fishing within the CCNM area.

Data Gaps: The data on commercial fishing may be misleading and may contain a fair amount of imprecision as a result of fisherman attempting to protect the secrecy of their fishing grounds. Data on sportfishing are lacking.

Future Needs: Available information appears sufficient to locate and document major commercial fishing grounds. Monitoring the frequency, type, and magnitude of sportfishing within the CCNM may be required to adequately assess its impact within the CCNM.

5.9 Research Sites

Information Available: Information on research sites is available from universities and colleges with marine biology–related programs. Organizations focusing on coastal restoration and seabird protection, such as the Pacific Seabird Group, may also be able to provide data.

Data Gaps: See *Biological Resources: Research Areas and Ecological Preserves* earlier in this section.

Future Needs: See *Biological Resources: Research Areas and Ecological Preserves* earlier in this section.

5.10 Mapping

Information Available: The study team can acquire GIS data from BLM for the coastal rocks and islands in addition to the coastline, as well as ownership data, if needed. Additional GIS information may be available from DFG, State Parks, and Department of Conservation. The study team currently has digital 1:24,000 scale topographic maps, but this scale may not be sufficient for the mapping needs of the coastal project.

Data Gaps: The study team needs to inquire from other federal and state agencies for additional digital spatial information that may be available for the coastline project.

Future Needs: The study team needs to discuss and agree upon a solution or a set of solutions for creating maps at a variety of scales from programmatic to project specific size for all or parts of the coastline. A hardcopy solution for a project-level set of maps is most likely not appropriate, but an electronic solution (e.g., ArcIMS, pdf, other spatial viewer) may be most flexible and cost effective. Jones & Stokes is working on an ArcIMS site that can potentially serve this purpose, or other agencies may have their own system.